REMARKS

Reconsideration and allowance are respectfully requested.

Claims 20-37 stand rejected under 35 U.S.C. §101 as allegedly being non-statutory. This rejection is respectfully traversed.

During a telephone conversation conducted with SPE Pham on March 3, 2009 discussing this rejection, it was suggested that claim 20 recite that a "computer-controlled node in the multi-hop communications network" performs the two determining steps. Claim 20 has been so amended. Accordingly, this rejection has been overcome and should be withdrawn.

Claim 38 stands rejected under 35 U.S.C. §102 as allegedly being anticipated by Biswas. This rejection is respectfully traversed.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631 (Fed. Cir. 1987). There must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention. *Scripps Clinic & Research Found. v. Genentech Inc.*, 927 F.2d 1565, 1576 (Fed. Cir. 1991). Biswas does not satisfy this rigorous standard.

It is important to understand the differences in objective and operation of two routing functions—cost determination and forwarding. Both functions will be dealt with in turn. First, cost determination refers to the process of determining a measure of how "close" a node is to some destination and is executed independently of traffic forwarding. An example of a cost determination scheme for routing is shortest path routing. In shortest path routing, the cost determination provides a single route between each source and destination so that a node having a packet to send knows to which next node to forward a data packet.

Claim 38 recites a node that is arranged to implement a new cost determination scheme, where the node calculates its closeness (cost), not based on the cost to one neighbor node and its associated cost, but rather the costs to multiple neighboring nodes and their individual costs. The inventors realized that shortest path algorithms are ill-suited for opportunistic forwarding schemes, like SDF, MDF and EXOR, and as a result, invented a cost determination mechanism that works well with opportunistic forwarding. With the cost determination approach recited in claim 38, each node has a set of potential links to different neighboring nodes, and the cost which a node assumes is a weighted/dependent cost of multiple neighboring node costs and the cost to reach each of them. This is different from simply offering a single fixed path between the source and destination as in a shortest path routing algorithm. The multiple potential paths reach out from each node with all the nodes together forming a mesh. The claimed cost determination typically provides lower costs because it accounts for redundant paths.

A simple, non-limiting illustration of the cost determination in claim 38 is compared to a shortest path algorithm. The shortest path algorithm, for two neighbor nodes 2 and 3, calculates a cost at node 1 (C1) as follows:

$$C_1=\min(\Delta C_{12}+C_{12}, \Delta C_{13}+C_{13}).$$

Assuming that the second argument is the smallest, i.e., shortest path, the resulting cost is:

$$C_1=\Delta C_{13}+C_{13}.$$

Thus, C_1 is only based on the cost of one neighbor node 3, i.e., C_{13} (as well as ΔC_{13}). In contrast, the node in claim 38 may be arranged to calculate the cost as:

$$C_1=f(\Delta C_{12}+ C_{122}, \Delta C_{13}+ C_{13}), \text{ where } f \text{ is a function.}$$

The result may for instance be a weighted result such as:

$$C_1=\alpha*(\Delta C_{12}+ C_{12}) + \beta*(\Delta C_{13}+ C_{13}),$$

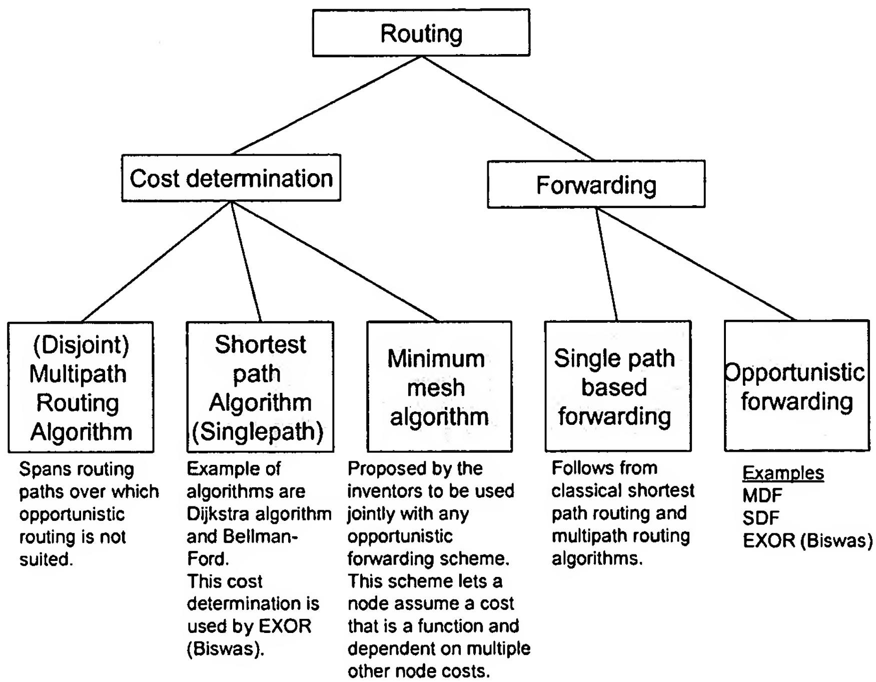
where α and β are weighting factors. Accordingly, C_1 is based on the cost of both node 2 and node 3.

The second routing function is forwarding of data packets. In shortest path routing, forwarding only involves deciding which packet to send if multiple packets are available, and when to send a packet, since the path is given by the shortest path determined in the cost determination process. Opportunistic forwarding refers to deciding a next hop node to send to, which packet to send if multiple packets are available, and when. The sending node bases the decision in part on the cost of the other nodes, (determined by the cost determination routing function as described above), and preferably the momentary link cost to those nodes. A metric may be calculated indicating an effectiveness or desirability of each forwarding choice.

There are two basic opportunistic forwarding schemes: SDF and MDF (EXOR relies on the same mechanism as SDF). In SDF, a packet is broadcast with a list of candidate receivers. Those candidate receivers may be preselected. In EXOR, for example, the selection of the candidates is based on the cost determined through a shortest path algorithm. Then, the data packet is sent, and multiple acknowledgements are returned. Based on the acknowledgements, one node is selected to forward the data packet. This selection can again be based on the cost of the receiving nodes. In MDF, a sending node multicasts a probe to multiple nodes, and a channel quality is returned to the sender by one or more of the multiple nodes. The sender then uses the

costs at the one or more nodes that returned a channel quality measure along with their channel quality measures to determine to which node to send a data packet.

The picture below provides an overview of the relation between the two routing functions, the approach described in the application, and Biswas.



With this introduction of the differences between cost determination and forwarding, the Biswas reference is specifically addressed and distinguished. Biswas is concerned with opportunistic forwarding. In section 3.1, Biswas makes clear that the candidate list is calculated based on an underlying shortest path determination. The selection of candidates to be indicated in the packet header is determined by selecting the neighbors having the least number of hops and breaking ties between them using a delivery ratio matrix. It is important to understand that the shortest path algorithm corresponds to the cost determination algorithm in Biwas. But

Biswas does not describe the details of how the shortest path/cost determination algorithm operates.

Claim 38 is directed to cost determination and recites "cost determination independent of data packet forwarding." In Biswas, cost determination is performed during packet forwarding. Biswas also assumes a shortest path cost determination algorithm to operate and support the candidate list determination. But Biswas does not describe the cost determination features in claim 38 such as "means for determining a plurality of simultaneously potential next hop nodes for said node, such that said simultaneously potential nodes jointly optimize a predetermined cost function." Biswas does not describe a cost function, optimization of a cost function, or joint optimization of a cost function for multiple simultaneous nodes.

Claim 38 also recites "means for determining an optimal cost for the node to be equal to the optimized value of the predetermined cost function, wherein said optimal cost is dependent of a respective cost for each of said plurality of simultaneously potential next hop nodes." Because the optimized value is set as the cost for a node, the cost which a node assumes is a cost that depends on multiple neighboring node costs and the cost to reach each of them. In contrast, the cost associated with a node in Biswas only depends on one neighboring node because Biswas uses a shortest path algorithm for cost determination.

Because Biwas lacks multiple features in claim 38, the anticipation based on Biwas should be withdrawn.

The application is in condition for allowance. An early notice to that effect is requested.

Respectfully submitted,

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